

# GROUND-BASED REGIONAL GNSS AUGMENTATION

## European Precise Positioning

Global Navigation Satellite Systems (GNSS) like GPS, GLONASS and, soon, Galileo are used for many positioning and navigation applications. But existing GNSS accuracy and reliability do not satisfy all clients. Ground-based augmentation systems provide GNSS observation data and real-time corrections for high-precision positioning and navigation. EUPOS is an initiative to build and run such systems with uniform standards and full-scale accuracy in fifteen Central and Eastern European countries.

The European Position Determination System (EUPOS) is both an international initiative and a project to establish a uniform Differential GNSS basis infrastructure in Central and Eastern Europe (CEE). Uniform ground-based multifunctional DGNSS reference-station systems and services are being built in the participating countries. Given the ever-increasing globalisation of economic relationships, Europe needs an infrastructure favourable for positioning and navigation. Almost 80% of all political decisions are based on spatial information, so that this needs to be provided effectively and efficiently. A corresponding infrastructure helps to safeguard and strengthen regions both as a whole and in terms of economic growth. It supports the development of the social aspects of cities and regions, management and optimisation of land, air and water traffic, disaster management, public-security duties, hydrography, protection of the climate and environment etc. The factual constraints demand cost-effective solutions, further development of technical capabilities and mastery of forward-looking technologies. (cf. EUPOS maps).

### Technical Potential

The technical possibilities offered by GNSS give the official authorities responsible for spatial reference systems the chance to fulfil their mission of supplying geodetic reference systems efficiently and in accordance with requirements. The current availability of two parallel systems, the US Navstar GPS and the Russian GLONASS system offers the necessary safeguards, taking into consideration the official statements relating to their continued usability and future development. These systems will eventually be supplemented by Galileo; developed by Europe as the first civilian GNSS. Galileo as a European spatial information infrastructure attains to very concrete political and economic use. Spatial information makes transparent and comprehensible decisions possible at European, national and regional levels.

### Ground-based Systems

The achievable single-point accuracy with GNSS is not high enough for many applications. For position fixing with an accuracy better than about the 5–20m possible with absolute GNSS, many European countries have set up Differential GNSS (DGNSS) reference-station services providing differential GNSS correction and observation data for real-time positioning or post-processing. With these products the state survey administrations provide fundamental infrastructure for all spatial and land-related information as an important base for planning and administrative, legal, economic and scientific activities. Unfortunately, the DGNSS reference-station systems already existing in Western Europe are often not compatible since they do not use the same standards. Experienced experts from the CEE countries saw a chance to avoid these difficulties in CEE as they began to think about the establishment of compatible DGNSS augmentation systems.

### EUPOS

EUPOS is a ground-based European regional GNSS augmentation system. It is building more than 860 DGNSS reference stations in participating countries. The most important fact is that EUPOS provides data to uniform standards in fifteen Central and Eastern European countries. Members of the EUPOS co-operation are topic-ally Bosnia and Herzegovina, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Russia, Serbia, Slovakia, Ukraine and, in an

advisory capacity, the German states of Berlin and Hamburg. Slovenia has observer status. EUPOS will cover about 25% of European Union territory and more than 60% of the area of the whole of Europe. Taking into consideration also Russian territory in Asia, where this infrastructure will be established, EUPOS will be realised for an area of about 10 million square kilometres. (cf. EUPOS maps)

#### Technical Basis

The fundamental infrastructure is based technically on a network of GNSS reference stations and adequate communication lines. The data products can be used in many different applications requiring accuracy better than 3m and up to 1cm-level in real-time and sub-centimetre precision with post-processing. This 'full-scale accuracy' concept targets all types of users, from environmental protection, transport and public security, hydrography, maritime surveying, river and maritime traffic, fishing, machinery and vehicle control, to spatial data infrastructure developers and geodesy. EUPOS is independent of private-company solutions and uses only international and unlimited worldwide usable standards. In cases where internationally agreed standards do not exist, EUPOS is working on standardisation with corresponding organisations such as the Radio Commission on Maritime Services, and the Special Committee 104 (RTCM SC 104). EUPOS provides the GNSS observation data and real-time corrections for high-precision positioning and navigation with guaranteed availability and quality.

#### Organisation

The responsibility for developing and operating the EUPOS reference station network is distributed among participating organisations at national level, which gives the characteristic flavour of the organisation. Providing the backbone for developments are the International EUPOS Steering Committee and the National Service Centers (NSCs) concept, which requires the establishment of NSCs in every participating country. The NSCs are responsible not only for network developments and operation but also provide focal points for user information, quality and integrity assurance and international relations with other EUPOS countries. The International EUPOS Steering Committee decides and agrees the organisational and technical framework for EUPOS. The ISC Office (ISCO) at the Senate Department for Urban Development in Berlin/Germany is the central point of contact for interests of international importance. The ISC may establish working groups to investigate specific areas of interest, co-operation and co-ordination. Two EUPOS working groups have been established in 2006: one on Technical Co-operation with the Industry (TCI) and one on System Quality, Integrity and Interference Monitoring (SQII).

#### Membership

The membership of EUPOS is voluntary, but members are obliged to observe the defined and unified standards of the EUPOS initiative. Countries that would like to join are asked to contact the ISC or the ISCO. The admission of a new member to the organisation will be confirmed by ISC resolution. Normally, those government authorities responsible for the geodetic reference system of a country become a member of EUPOS. These are particularly the surveying administrations, but also authorities for outer-space affairs. Every EUPOS member delegates a representative to the ISC. It is also acceptable if the responsible government body authorises another person to be its representative at ISC.

#### Co-operation

ISC members are actively working in several organisations to promote EUPOS activities. Very important here is co-operation with the

United Nations Office for Outer Space Affairs (UN OOSA). This has noted with satisfaction that EUPOS would be the first ground-based GNSS infrastructure of its kind with regional reach and that it would significantly enhance the scope of use and applications for GNSS, as well as their scientific, social and economic benefits. EUPOS has also gained membership of the International Committee on GNSS (ICG). This was founded on the recommendation of the UN General Assembly in order to maximise the benefits of the use and applications of GNSS, to support sustainable development and to promote system compatibility and integrity between the different GNSS and augmentation systems.

#### Concluding Remarks

EUPOS for the first time gives providers of ground-based DGNSS augmentation systems use on a voluntary basis of uniform standards over a huge area. This will be of interest not only to national decision-makers and clients, but also to international organisations. EUPOS by its trans-national compatible activities promotes the economic development of various applications and supports the growing together of the countries of Europe. [For more information see the website www.eupos.org](http://www.eupos.org).